

dynasties, which throw some light on the early history of this region.

The author describes the ancient temple at Nhangrang, stone built, with inscriptions in primitive Pali, similar to those found in Nakhon Wat, and other monuments scattered over a vast area.

In conclusion, the book covers a wide field of interest, and is a welcome addition to the literature of further Asia.

J. THOMSON.

LAKE CHAD.¹

THE first volume gives the geographical results of the mission presided over by Captain Tilho (which undertook, in connection with British delegates, a delimitation of the Anglo-French frontier in the region of Lake Chad and northern Nigeria). The main purport of this volume is the survey and delineation of that extraordinarily puzzling feature in African geography, Lake Chad—a "lake" described by Captain Tilho as being nothing but an immense marsh with variable stretches of open water nowhere more than 12 feet deep.

Probably the first definite mention of Lake Chad (under the name of Zad) occurs in the writings of Frederick Hornemann, at the very close of the eighteenth century. (Hornemann, who was taken into the employ of the English African Association, and sent by them to reveal this lake and also the central course of the Niger, is believed to have reached the Niger and to have died in the Nupe country about 1800.) But rumours of a great sheet of water in the heart of Africa, beyond the Sahara Desert, had probably reached the Romans in the first century of the Christian era, through their connection with Tunis, Tripoli, and Fezzan, and these stories were reflected in the conjectured Libya Palus of Claudius Ptolemæus, who wrote in the middle of the second century. When the Arabs and Moors had become thoroughly acquainted with the geography of the Sudan they revived these traditions, but mixed them up with both the Niger and the Nile systems.

As a matter of fact, the basin of Lake Chad is curiously on the balance between the watersheds of the Nile and of the Niger. The work of other and earlier French expeditions (especially that of Dr. Auguste Chevalier) which preceded that of Captain Tilho has put before us evidence of a faunistic and geological character which prompts the supposition that Lake Chad is the very last vestige (shrinking annually, one might say) of a vast, shallow, inland sea, which covered much of the region north, east, and, above all, west of Lake Chad, of the basin of the Niger north of the mountains, and probably communicated with the sea along the basin of the Senegal River. Whether there was any north-eastern outlet towards the Nile basin is more doubtful. Looking at the most recent map of Africa in relief, it would seem more probable that there has been for ages a bridge of high land through the Tibesti country which has connected southern Tunis with Central Africa, and separated the Niger-Chad basins from that of the Nile; but it is more likely that down to the close of the Secondary epoch, or even at the very beginning of the Tertiaries, there may have been a connection between the Chad-Shari basin and that of the Congo. Nearly the whole of the Congo basin was, down to a relatively recent period, a vast fresh-water lake. A rise of ground so slight as scarcely to be perceptible to the traveller separates at the present day the basin of the Shari River from that of the

Mubangi-Wele, which, of course, marks the existing limits to the north of the former Congo Sea, that sea which in Tertiary times forced its present narrow outlet through the Crystal Mountains into the southern Atlantic. Many arguments for the justification of these hypotheses (as also for arguing the relatively early detachment of the Congo Sea from that of the Sahara) may be found in the remarkable works of Mr. G. A. Boulenger on the fresh-water fishes of Africa. From this same source, again, may be derived further arguments for the relatively recent existence of the Chad-Niger Sea, and perhaps also for the close geographical connection between that vast area of fresh water and the great lake which formerly filled up much of the Bahr-al-Ghazal-and-Upper-Nile regions, a lake represented at the present day by the Sudd region.

Other French expeditions dealing with the country between Lake Chad and the Mubangi-Congo have established the existence (it is said) of the manati in the Shari River, and, above all, in the isolated lakes and pools to the north-east of that stream. The manati is also stated to be found in the Niger River between Sego in the west and Yauri in the east. If this is really the case, it is further evidence for the existence and the relatively recent drying-up of this vast fresh-water Sahara Sea; for the manati is a Sirenian mammal the nearest relations of which are found fossil in lower Egypt, in the West Indies, and in Florida. The manati is still found as a living animal in the estuaries and broader rivers of West Africa, but it would be exceedingly difficult for it to reach the Upper Niger over the Busa Rapids, though it might, and perhaps does, pass up the river Benue, and thus reach the Shari by way of the Tuburi marshes. (The manati is not found in the Upper Congo.) With regard to these Tuburi marshes, we have here a very interesting problem to discuss. Another French scientific expedition established not long ago the feasibility of passing from the Upper Benue by canoe through the Tuburi marshes into the Logun River, and thus into the Shari and Lake Chad. Its leader (Lieut. Faure) has proved that at the height of the rainy season of that particular year there was continuous water communication between the mouth of the Niger and Lake Chad, so that Lake Chad was then nothing but a backwater of a river system in Central Africa which sent a superfluity of its waters to the Benue and the Niger.

Captain Tilho's work, however, though it touches on some of these hydrographical problems, deals mainly with the configuration of Lake Chad, in the volume under review. It shows that the average depth of the lake is only 1 metre 50 cm. (say 4 feet 10 inches), and in the great stretches of open water scarcely more than about 3 metres (say 10 feet). It is simply a vast swamp joining the waters of the Komadugu, which enters the Chad on the north-west, with the floods of the Shari coming in on the south-east. During the three years of study devoted by this mission, the only area of open water remaining in the Chad was quite outside British political limits, and lay to the north and north-west of the Shari delta. The rest of the lake surface was either completely dry land (north of the Komadugu River) or it consisted in the east of an archipelago of almost innumerable islands interspersed with lagoons, pools, and navigable creeks. Where Denham saw the waters of Lake Chad at Ngigmi in 1822 there may be a few tiny pools or a small area of moist ground, but the rest of the northern third of the lake has become absolutely dry land.

No doubt to the later expeditions of Barth and Vogel the surface of open water in Lake Chad was

¹ République Française. Ministère des Colonies. "Documents scientifiques de la Mission Tilho" (1906-9). First Volume. Pp. lx + 412 and Cartes. (Paris, Imprimerie nationale, 1910.)

already much restricted and blocked with swamp vegetation. There has been not only partial desiccation due to a lessening in the rainfall of West Central Africa, but also a raising of the lake level by the excessive growth of marsh vegetation—papyrus, reeds, rushes, grasses, and the ambatch tree. The water of Lake Chad would also seem to be increasing in salinity, which, however, does not appear to interfere with the growth of vegetation. On the contrary, when every now and then (according to the stories of the natives) the lake is partially recreated by floods from the Shari and the Komadugu and the water becomes fresh, the vegetation tends to disappear, partly by its being drowned, and partly because the water has lost some element suited to its growth.

Some further geographical information is given as to the Bahr-al-Ghazal Channel, or Soro, as it should preferably be called (in order not to confuse it with the name of the western basin of the Nile). This would seem to have been an ancient outlet of the flooded Chad, which carried these waters along a definite channel towards the north-east into the Bodele depression. Another possible *déversoir* of Lake Chad exists still in Lake Fitri, far away to the south-east, which this mission showed still to possess an area of open water of nearly 150 square miles.

H. H. JOHNSTON.

NOTES.

WE have received a programme of the International Congress on Radiology and Electricity to be held at Brussels on September 13-15. Among the important matters to be brought forward is the question of radium standards and nomenclature. The congress will be divided into three sections. In the first section, general questions of terminology and methods of measurement in radio-activity and subjects connected with ionisation will be discussed. The second section will be devoted to subjects relating to the fundamental theories of electricity, the study of radiations (including spectroscopy, the chemical effects of radiations, and allied subjects), radio-activity, atomic theory, and cosmical phenomena, such as atmospheric electricity and the radio-activity of the atmosphere. The third section is biological, and will be devoted to the consideration of the effects of radiations on living organisms. This section will deal with purely biological subjects, as well as the use and application of various radiations for medical purposes. A long list of papers already promised is given in the programme, as well as a list of members up to date. A special exhibit of apparatus relating to the work of members is to be held in connection with the congress, and members are invited to forward exhibits to the Physical Laboratory of the University of Brussels. A number of excursions have already been arranged to take place after the congress, and special facilities will be granted to members on the Belgian and French railways. Intending members should communicate with Dr. J. Daniel at Ostende, rue Wellington 28.

THE preliminary programme of the twenty-fifth congress of the Royal Sanitary Institute, to be held in Brighton on September 5-10 under the presidency of Sir John A. Cockburn, K.C.M.G., has now been issued. Dr. A. Newsholme (Principal Medical Officer, Local Government Board) will deliver the lecture to the congress on "The National Importance of Child Mortality." Dr. Alex. Hill will deliver the popular lecture on "The Bricks with which the Body is Built." In connection with the congress, a health exhibition of apparatus and appliances relating to health and domestic use will be held as practical illustra-

tion of the application and carrying out of the principles and methods discussed at the meetings. The congress will include general addresses and lectures, and there will be two section meetings for two days each, dealing with:—Section i., sanitary science and preventive medicine, *president*, Prof. E. W. Hope; Section ii., engineering and architecture, *president*, Mr. H. Rofe. Eight special conferences will be held, dealing respectively with municipal representatives; port sanitary authorities; medical officers of health; engineers and surveyors to county and other sanitary authorities; veterinary inspectors; sanitary inspectors; women on hygiene; and hygiene of childhood.

THE death is announced, at seventy-five years of age, of Prof. F. von Neumann, who from 1876 until 1909 held the chair of political economy at the University of Tübingen.

WE regret to see the announcement of the death of Dr. Louis Olivier, at fifty-six years of age. Dr. Olivier was the founder and editor of our esteemed contemporary the *Revue générale des Sciences*, which ever since it first appeared, twenty years ago, has taken a leading place among the scientific periodicals of the world.

THE International Horticultural Exhibition of 1912 will be held in the grounds attached to the Royal Hospital, Chelsea. These beautiful grounds were laid out by Sir Joseph Paxton, and they are well adapted for the purposes of a horticultural exhibition. The area leased to the exhibition authorities is approximately twenty acres, and nearly sixteen will be directly available for the accommodation of the exhibits. In the remaining portion, which includes some shrubberies, there are many fine specimen trees.

THE following news of north polar exploration has been sent to London by the manager of the Nordenfjeldske Steamship Company of Trondhjem:—*Kong Harold* has returned from polar ice. Reached 80° 10', within 10° Pole. Met *Fram* expedition at Spitsbergen. *Fram* has discovered volcano and hot springs Wood Bay; beach covered with lava. Zeppelin has taken possession of tract of land at King's Bay, and has named it Zeppelinhafen.

It is reported by the Polar Sea yacht *Laura*, which arrived at Tromsø on August 17 from East Greenland, that the expedition ship *Alabama*, belonging to the Danish explorer Captain Mikkelsen, was crushed by the ice at the end of March last. The crew were saved, and wintered on Shannon Island. The Copenhagen correspondent of the *Morning Post* states that Captain Mikkelsen with Mr. Iversen, who started from Shannon Island on March 3, are trying to reach Cape York, on the western coast of Greenland, travelling by way of Peary Channel and the inland ice. If insurmountable difficulties are encountered, they can return to Shannon Island, where a house, in which there are provisions sufficient for two years, has been built. On August 7 Captain Mikkelsen and his companion had not yet returned, and it is supposed that they continued their way through the Peary Channel to Cape York, or that they are returning along the east coast, having spent the summer there.

THE Anthropological Society of Paris, in the last issue of its *Bulletins et Mémoires*, gives a report of the meeting, attended by leading anthropologists from all parts of Europe, to commemorate the fiftieth anniversary of its foundation. An interesting feature in the report is a series of papers contributed by the foreign delegates describing the progress of research in the various parts of Europe. As representative of the Royal Anthropological